



New High Yielding Short Duration Pearl Millet Hybrid: TNAU Cumbu Hybrid CO 9

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A high yielding and early maturing pearl millet hybrid, TNBH 0642 was developed from a cross between Cytoplasmic male sterile line ICMA93111 and a pollinator line PT 6029-30 at Department of millets, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore-3 during *kharif* 2005. It has been tested extensively in Tamil Nadu and in other states *viz.*, Karnataka, Andhra Pradesh and Maharashtra, under MLT, ART, OFT and All India Co

- ordinated programme for the past five years. The hybrid performed well both under rainfed and irrigated situations in Tamil Nadu. This hybrid is of medium in stature (160 -180 cm) and early in duration (matures in 75-80 days). It produces 4-6 productive tillers with candle shaped earhead. The size of the grain is bold and is greyish yellow in colour. The hybrid TNBH0642 is highly resistant to downy mildew under both normal and sick plot conditions. This new hybrid recorded a mean grain yield of 3728 kg / ha under irrigated conditions, which is about 30 and 24 percent increase over the checks X7 and NH 07 respectively. The mean grain yield under rainfed conditions is 2707 kg /ha which is 18 and 19 per cent increase over X7 and NH07 respectively. The iron content in the grain is high (8 mg / 100 g). It has acceptable cooking quality and has consumer preference due to its flavor, taste and keeping quality of the cooked preparations.

Key words: TNBH 0642, Cumbu hybrid CO 9, short duration, downy mildew resistance.

Pearl millet (*Pennisetum glaucum* (L) R.Br) is an important crop grown over 40 countries, predominantly (>55% of global millet production), in Africa and Asia, where the growing conditions are dry and infertile to grow most other grains. In the world, pearl millet ranks in its importance after wheat, rice, corn, barley and sorghum. As a cereal for human food, it is considered to be highly palatable and most nutritious. Apart from being used as food for human consumption and feed for livestock and poultry, pearl millet grain is also gaining importance as a cheap source of starch for fine quality brewing and in other diversified food uses. It is the most drought and heat tolerant cereal crop hence its cultivation is spreading intensively in the traditional areas and extensively in newer areas where water scarcity is prevalent. Among the cereal crops it has the highest water use efficiency under drought stress.

The availability and knowledge on the development of CMS lines, their maintainers and restorers, made it possible to produce the seed of commercial single-cross F₁ grain hybrids in India (Athwal, 1966). Such hybrids have substantial yield advantage over popular open pollinated varieties (OPVs). In pearl millet the Tift 23A CMS line was,

extensively utilized in India, and more number of hybrids was released for commercial cultivation (Dave, 1987). Production increased from 3.5 to 8.0 million tons during this period. Intensive cultivation of hybrids based on a single male sterile line resulted into cytoplasmic and genetic homogeneity leading to downy mildew epidemic. Hence, development of hybrids with downy mildew resistance is essential in pearl millet improvement programme.

Materials and Methods

Fresh crosses of 500 numbers were synthesized involving ten cytoplasmic male sterile lines (CMS lines) and fifty restorer lines during *kharif* 2005 at Department of Millets, Centre for Plant Breeding and Genetics, TNAU, Coimbatore-3. All the synthesized hybrids were evaluated along with the checks X7 and NH 07 (Nath hybrid seed). Among the hybrids synthesized, the hybrid TNBH 0642 performed better than all other hybrids tested. Hence, the hybrid, TNBH 0642 involving ICMA 93111 as female parent and PT 6029-30 as male parent was identified as promising high yielding hybrid and was promoted to test under advanced yield trials from 2006-2010. Based on its performance, the hybrid TNBH 0642 was promoted and evaluated in Multilocation trial (MLT) at different research stations during 2007-2008. Then it was

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promoted to Adaptive Research Trials (ART) and On Farm Trials (OFT) and evaluated both under rainfed and irrigated condition during 2008-10. In addition, this hybrid was also tested under ICAR-All India Coordinated pearl millet trials in Zone A (Northern states of the country) and B (Southern states of the country) during 2008-09 and was promoted to next stage in Zone B during (2009-10). A total of 140 and 88 trials were conducted under irrigated and rainfed condition respectively. Simultaneously, this hybrid was also screened for diseases viz., downy mildew, rust and ergot under both field and sick plot condition. Besides, the grain quality traits, viz., carbohydrate, protein, fat, phosphorous and iron were also analyzed following the standard procedures.

Results and Discussion

The hybrid TNBH 0642 was tested in station trials from 2005-09 at Department of Millets, Centre for Plant Breeding and Genetics, TNAU, Coimbatore. It recorded an average yield of 4343 kg/ha over eight season under irrigated condition. It was 38 and 28 percent increased yield over the check hybrids X7 which recorded 3156 and NH 07 with 3381 kg/ha

Table 1. Performance of TNBH 0642 in Station trials for grain yield (kg/ha)

	TNBH 0642	X7	NH 07
Irrigated			
Kharif			
2006	4494	3186	3383
2007	3826	2785	2968
2008	4375	3250	3381
2009	4515	3175	3325
Mean	4303	3099	3264
Summer			
2006	3975	3156	3426
2007	4387	3255	3525
2008	4486	3245	3625
2009	4679	3195	3410
Mean	4382	3213	3497
Mean (Irrigated)	4343	3156	3381
% increase over respective check	38	28	
Rainfed (Rabi)			
2005	1745	1380	1460
2006	1915	1400	1425
2007	1888	1425	1510
2009	1950	1350	1430
Mean (Rainfed)	1875	1389	1456
% increase over respective check	35	29	

respectively. Under rainfed condition, TNBH 0642 was evaluated in four seasons and it yielded 1875 kg/ha, while the check X 7 recorded 1389 kg/ha and NH 07 recorded 1456 kg/ha. It was 35 and 29 percent higher than X7 and NH 07 (Table1). In earlier studies high mean grain yield was reported by Santosh (2002), Izge *et al.* (2007) and Chotaliya *et al.* (2010).

Under multilocation trials, the hybrid was tested over five locations in irrigated and three locations under rainfed situations with the check X7 and a private hybrid NH 07 (Table 2). The test hybrid recorded an average yield of 3596 and 3012 kg/ha under irrigated and rainfed conditions respectively. This was 43 and 30 percent under irrigated and 11 and 25 percent under rainfed condition higher than the checks X7 and NBH 07 respectively.

Table 2. Performance of TNBH 0642 in Multilocation Trial 2007-08

	Grain yield (Kg/ha)		
	TNBH 0642	X7	NH 07
Irrigated			
Bhavanisagar	2257	1494	1528
Vaigaidam	4082	2549	3776
Coimbatore	4450	3490	3005
Mean	3596	2511	2770
% increase over respective check	43	30	
Rainfed			
Kovilpatti	3216	2999	2991
Aruppukottai	2072	2338	1881
Coimbatore	3750	2777	2376
Mean	3012	2705	2416
% increase over respective check	11	25	

This hybrid was tested under 52 adaptive research trials during 2008-10 under irrigated condition and 66 locations during 2008-09 under rainfed condition. The results revealed that the superiority of the hybrid in grain yield. The hybrid THBH 0642 gave an increased grain yield of 16 and 15 per cent over the checks X7 and NH 07 under irrigated condition respectively (Table 3). It gave 2615 kg/ha of grain yield which is 10 and 5 per cent greater than X7 (2384 kg/ha) and NH07 (2501 kg/ ha) under rainfed condition respectively.

Table 3. Performance of TNBH 0642 in Adaptive Research Trial for grain yield (Kg/ha)

Location	No. of locations	TNBH 0642	X 7	NH 07
Irrigated				
Summer 3/ 2008-2009	24	2376	2124	2142
Summer 3/ 2009-2010	28	3123	2621	2637
Mean	52	2750	2373	2390
% increase over respective check	16	15		
Rainfed				
Kharif 1/ 2008-2009	43	2563	2302	2397
Rabi 2/ 2008-2009	23	2675	2465	2552
Mean	66	2615	2384	2501
% increase over respective check		10	5	

Similarly this hybrid also performed better under All India Co-ordinated trials during 2008-09 under Initial Hybrid Trial (IHT) and during 2009-10 under Advanced Hybrid Trial (AHT). It recorded an average yield of 3139 kg/ha over 15 locations during 2008-9 and gave 10,20 and 64 percent increased grain yield over the National checks ICMH 356, Shradha

and Pusa 23 respectively. During 2009-10, this hybrid was tested under 18 locations and gave a grain yield of 3006 kg/ha which is 6, 35 and 2 percent higher than the checks, Shradha, Pusa 23 and ICMH 356 respectively.

Besides, this hybrid was also tested under 44 and 15 locations on farm trials (OFT) at farmer's holding under irrigated and rainfed conditions respectively. It gave 4223 kg/ha and 3325 kg/ha under irrigated and rainfed situations respectively.

Table 4. Average performance of TNBH 0642 in different trials for grain yield kg/ha

Details	TNBH 0642	X7	NH 07
Irrigated			
Station trial (8)	4343	3156	3381
MLT (3)	3596	2511	2770
ART (52)	2750	2373	2390
OFT (44)	4223	3453	3455
Mean	3728	2873	2999
% over X7	30		
% over NH 07	24		
Rainfed			
Station trial (4)	1875	1389	1456
MLT (3)	3012	2705	2416
ART (66)	2615	2384	2501
OFT (15)	3325	2673	2758
Mean	2707	2288	2283
% over X7	18		
% over NH 07	19		

The overall mean yield of the hybrid under 140 locations under irrigated and 88 locations under rainfed conditions showed that this hybrid was 30 percent superior over the check X7 and 24 percent superior over NH 07 under irrigated condition (Table 4) while, under rainfed situations, it showed 18 and 19 percent higher grain yield over X7 and NH 07 respectively.

Disease reaction: Shelke and Chavan (2010) reported that identification and selection of resistant parents is important for crossing programme

Table 5. Disease reaction of pearl millet hybrid TNBH 0642 under field condition

	Downy mildew (%)	Rust (%)	Ergot (%)
Under field condition			
NBH 0642	0	3.0	0
ICMA 9311A	0	8.0	0
PT 6029-30	0	9.0	0
X7	0	8.5	1.0
NH 07	0	6.0	2.0
Under sick plot condition			
TNBH 0642	0	2.5	1.0
ICMA 9311A	0	1.0	-
PT 6029-30	0.5	1.0	-
X7	0	11.0	2.0
NH 07	3.2	7.0	3.0

involving in the development of high yielding hybrids with downy mildew resistance. Angarawari *et al.*, (2008) reported that transfer of resistant to recipient parents by donor parents was highly possible. This new hybrid, showed nil incidence for downy mildew and ergot disease under field condition, while the rust percent was very low of 3 percent. The parents of this hybrid also showed resistance for downy mildew. While, the check hybrids, X7 and NH 07 recorded 8.5 and 6.0 percent of rust and 1 and 2 percent of ergot incidence respectively (Table 5).

Under sick plot conditions, the hybrid TNBH 0642 recorded 2, 2.5, and 1 percent of downy mildew, rust, and ergot incidence respectively (Table 6). Where as X7 recorded nil incidence to downy mildew and 11 percent of rust and 2 percent of ergot incidence. The private hybrid NH 07 recorded 3.2, 7.0, 3 percent of downy mildew rust and ergot diseases respectively. Hence, the hybrid TNBH 06 42 was resistant to all the three diseases.

Table 6. Grain and cooking qualities and organoleptic evaluation of the hybrid TNBH 0642

Quality characters	TNBH 0642	X 7	NH 07
Grain quality			
Carbohydrate (%)	62.0	68.0	68.0
Fat (%)	6.28	6.54	6.55
Protein (%)	9.43	11.04	9.8
Phosphorus(mg/100 g)	498	528	512
Iron (mg/100 g)	8.0	6.8	6.3
Cooking quality			
Initial weight (g)	100	100	100
Initial volume (ml)	120	120	120
Cooked weight (g)	182	180	170
Cooked volume (ml)	180	185	170
Water absorption (ml)	140	150	155
Time taken (min)	30	35	20
Organoleptic Score			
Colour	8	9	9
Flavour	9	8	8
Texture	7	8	8
Taste	8	9	8
Overall acceptability	8	8	8

Grain quality: This hybrid was on par with the check hybrid X7 in fat, and Carbohydrate contents. It recorded high iron content of 8 mg/100g which is higher than the check hybrids (Table 7). This hybrid has acceptable cooking quality and has consumer preference due to its flavor, taste and keeping quality of the cooked preparations.

Based on the above all desirable features, the pearl millet hybrid TNBH 0642 was released as TNAU Cumbu hybrid Co 9 by the Tamil Nadu Agricultural University during 2011 for pearl millet growing regions of Tamil Nadu.

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